FASTNEt: **F**luxes **A**cross**S**loping**T**opography of the **N**orth **E**ast A**t**lantic

The FASTNEt consortium was constructed by SAMS, NOC, U. Bangor, U. Liverpool, U. Plymouth and PML in response to a Call for Proposals to deliver the NERC Ocean Shelf Edge Exchange Research Programme. The FASTNEt consortium is a four year physical science research programme starting in October 1st 2011. FASTNEt's main aim is:

> To construct a new paradigm of Ocean/Shelf exchange using novel observations and model techniques to resolve the key *seasonal, interannual and regional* variation absent from existing knowledge.

FASTNEt recognises that shelf seas are a critical interface, linking the terrestrial, atmospheric and oceanic carbon pools and acting as a physical gateway to key biogeochemical fluxes. *We are therefore seeking to establish collaborations within our field and modelling programmes to combine our physical science advances with linked advances in biogeochemical processes and exchanges in shelf seas and at ocean margins.*

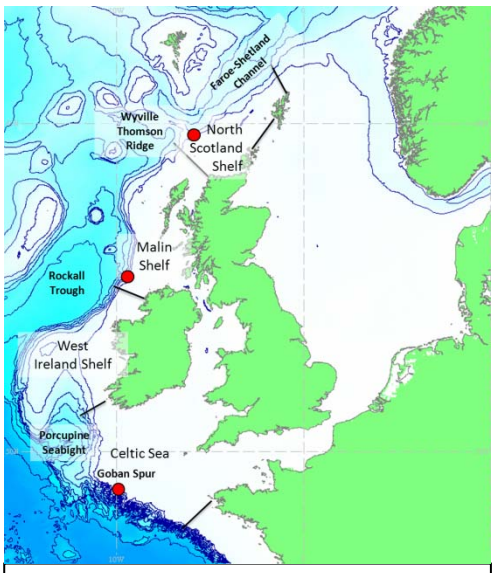

Figure 1: Regional map showing shelf sectors and intensive study regions.

Four objectives underpin our aim of constructing a new paradigm of Ocean/Shelf exchange:

1. To determine the seasonality of physical gradients and exchange across the shelf edge by deploying new observational technologies (Gliders, Autosub Long Range) and established techniques (long term moorings, drifters).

2. To quantify key exchange mechanisms and to collect new data targeted at testing and improving high resolution models of the shelf edge, by carrying out detailed process studies in contrasting regions of the shelf edge of the NE Atlantic margin

3. To develop a new parameterisation of shelf edge exchange processes suitable for regional-scale models, using improved resolution numerical, and new empirical models constrained by the observations.

4. To test the new parameterisations in a regional model in the context of making an assessment of inter-annual variability of ocean-shelf exchange.

To achieve the four objectives we have grouped the observational and modelling methodologies into four enabling packages (EPs). These enabling packages will deliver the major observational or modelled data sets which will enable the work packages to achieve their scientific advances. Three key west-European margin sites have been selected as they offer a range of contrasting exchange conditions: A) Celtic Sea edge, B) Malin Shelf, C) North Scotland Shelf (Fig. 2). At location 'A' the slope current is predicted to be highly stable whilst internal tides, though significant everywhere, promote greatest exchange here. Slope current meanders are predicted to have greater contribution to exchange at 'B' and greatest (via eddy exchange) at 'C'.

- Work Package 1: Seasonal and Regional Variation in Exchange
- Work Package 2: Slope Current: Recruitment, Meanders and Eddies
- Work Package 3: Internal Tide: Observation, Simulation, Parameterisation
- Work Package 4: Synthesis and Flux Budgets

We recognise that the pivotal point of scientific collaboration will be through sharing the use of, or access to, the Enabling Packages.

EP1: Remote Technologies. Gliders, AUVs, Drifters and long term moorings

Gliders: Gliders represent a fundamental leap in our ability to observe the ocean, particularly in winter. We will use 6 Gliders, to be deployed in pairs, to measure fluxes at three shelf edge locations: the Celtic Sea, the Malin Shelf and north Scotland Shelf.The Glider timetable is available from the PI, see contact details below. There will be an additional NERC Call for Proposals to enhance the Glider activity within FASTNEt.

Moorings: Long term (20-month) bed-mounted 75 kHz ADCP moorings will be deployed. On the Malin shelf edge three will cross the slope at the location of a persistent slope current meander. At the Celtic Sea shelf edge there will be two, one on the slope one on the shelf.

Autosub Long Range (ALR): ALR will be capable of moving horizontally at up to 1.3 m s^{-1}, like a conventional AUV, and dive to >1000 m, like a Glider. Five two-month missions are planned (each covering in excess of 2500km), with four to the long term Malin Shelf moorings to cover all seasons, and one winter mission to the Celtic Sea shelf edge mooring.

Drifters: Satellite tracked drifters give a unique, direct insight to the shelf edge as a barrier (or otherwise) to exchange. Delivering statistics on slope current strength and dispersion drifters will be deployed (sixty in total) at the Celtic Sea edge and North Scotland shelf in summer and winter.

EP2: Cruises

Two process study cruises are planned. There will be spaceon both, including scope for additional wire-time measurements (unfunded by FASTNEt). In particular CTD rosette and short term moorings might provide useful platforms for extra research.

Process Cruise #1: RRS Discovery, Celtic Sea shelf edge, 21 days. June 2012.

Process Cruise #2: RRS James Cook, Malin Shelf edge, 24 days. Summer 2013

EP3: Models

1. A northern North Atlantic model (NNAM) spanning the Atlantic from Greenland to North Africa at ~7km resolution.
2. An eddy permitting model (HRCS) of the whole NW European shelf from 48˚N to 63˚N at ~1.8km resolution.
3. A west Coast domain (WCM).Being substantially faster to run this model will be used for the sensitivity experiments.
4. The Atlantic Margin Model. This provides a coarser resolution model for sensitivity experiments (WP4) and a direct connection between the parameterizations developed herein and by UKMO.

EP4: Earth Observation

There are two strands to our proposed EO activities. First, process cruises will be supported by near real-time EO data (SST, ocean colour products, SAR, SST gradient derived frontal maps). Second, eddy kinetic energy (EKE) will be estimated using geostrophic currents derived from sea-surface height anomaly data (30 km gridded products, 1992-present); thesewill be analysed for seasonality and interannual variability and their statistics compared with numerical model hindcasts. In addition we will test the ability of SST and ocean colour frontal detection algorithms to recover the position of the inner edge of slope current.

Project Partners and collaborators: Significant value is added to FASTNEt by five Project Partners: UKMO, Marine Scotland Science, AFBI, Marine Institute Ireland and SCRIPPs.

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